

Neuroscience Midterm Version I

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1. The conduction velocity of myelinated nerve fibers is much higher than that of unmyelinated nerve fibers of similar diameter because:

- A. Myelinated nerve fibers do not have potassium channels to slow down the conduction.
- B. Sodium channels in unmyelinated nerve fibers are inactivated much faster than sodium channels in myelinated fibers.
- * C. Action potentials occur only in the nodes of Ranvier of myelinated fibers.
- D. Potassium channels are concentrated in the nodes of Ranvier.
- E. Chloride channels are concentrated in the nodes of Ranvier.

2. Opening of which type of channels upon depolarization of the nerve terminal is required for transmitter release:

- A. Voltage-gated potassium channels
- B. Ligand-gated potassium channels
- C. Ligand-gated sodium channels
- * D. Voltage-gated calcium channels
- E. Ligand-gated calcium channels

3. The reversal potential of an unknown neurotransmitter acting on a thalamic neuron is -78 mV. When the resting membrane potential of this neuron is -65 mV, what would be the most probable action of this neurotransmitter on the thalamic neuron?

- A. Depolarization of the thalamic neuron
- * B. Hyperpolarization of the thalamic neuron
- C. Activation of the Na^+/K^+ ATPase
- D. Inactivation of the Na^+/K^+ ATPase
- E. No change of the resting membrane potential

4. Myasthenia gravis is thought to be an autoimmune disease with antibodies directed against:

- A. Glutamate receptors
- * B. Nicotinic acetylcholine receptors
- C. Muscarinic acetylcholine receptors
- D. Glycine receptors
- E. 5-Hydroxytryptamine receptors

5. The binding of acetylcholine molecules to nicotinic receptors of the muscle endplate opens:
 - A. Chloride channels
 - * B. Sodium and potassium channels
 - C. Sodium channels only
 - D. Potassium channels only
 - E. Calcium channels only

6. The fusion of vesicles to presynaptic membrane is thought to be caused by:
 - A. Na ions
 - * B. Calcium ions
 - C. Guanine nucleotides
 - D. Acetylcholinesterase
 - E. Choline acetyltransferase

7. Apoptotic cell death is characterized by all of the following EXCEPT:
 - a. internucleosomal DNA breakdown
 - b. activation of 'death genes'
 - c. greater potential for prevention than necrotic cell death
 - d. occurrence during normal development
 - * e. cell body swelling

8. Following axonal injury all of the following occur EXCEPT:
 - * a. increased synthesis of neurotransmitter related molecules
 - b. retrograde cell death
 - c. enlargement of the nucleolus
 - d. anterograde transneuronal degeneration
 - e. breakdown of rough endoplasmic reticulum

9. Cut axons in a peripheral nerve can regrow to their target. Characteristics of such a regenerative response include all of the following EXCEPT:
 - a. growth along a Schwann cell basement membrane
 - b. growth at 1 mm/day
 - c. imprecision of regrowing axons for choosing appropriate distal band of Bungers
 - * d. delay by inhibitory components in peripheral nerve myelin
 - e. initial delay before growth cones traverse the injury site

10. Your patient has a bullet wound that has extensively damaged the corpus callosum. This wound would primarily involve axons of which of the following cortical cells?
 - a. granule cells
 - b. astrocytes
 - * c. pyramidal cells
 - d. microglia
 - e. purkinje cells

11. All the following are true about the neocortex except:
- a. it is contained in 2 hemispheres, each of which contains 4 lobes
 - b. it typically consists of 6 layers or laminae of cells
 - c. it contains cell bodies of 2 basic types of neurons
 - * d. it receives direct axonal inputs from the spinal cord
 - e. it receives direct axonal inputs from the thalamus
12. The cortical efferent neurons that send their axons to subcortical structures use _____ as neurotransmitters.
- * a. glutamate and aspartate
 - b. somatostatin and substance P
 - c. GABA and glutamate
 - d. GABA and neuropeptide Y
 - e. glutamate and serotonin
13. All the following are brainstem or diencephalic structures that provide direct axonal inputs to neocortex except:
- a. locus ceruleus
 - b. raphe
 - c. thalamus
 - d. ventral tegmentum
 - * e. dorsal column nuclei
14. Which of the following statements about the archicortex is true?
- a. The archicortex is located in the frontal lobe.
 - * b. Archicortex structures contain fewer than 6 cortical layers.
 - c. The archicortex makes up almost 90% of the human cerebral hemisphere.
 - d. The anterior perforated substance is part of the archicortex.
 - e. The archicortex and neocortex make up the allocortex.
15. The interneurons of the cerebral cortex are called _____. The main transmitters/modulators of these cells include _____.
- * a. granule neurons; GABA and peptides
 - b. pyramidal neurons; glutamate and serotonin
 - c. astrocytes; glutamate and aspartate
 - d. stellate neurons; dopamine and acetylcholine
 - e. none of the above
16. You have a patient who has lost light touch sensation from the fingertips due to severe burns of the fingertip skin, and related loss of sensory receptor endings. From your knowledge of the normal innervation of the fingertip skin, this sensory deficit would primarily involve loss of the following types of receptor end organs:
- a. muscle spindles and merkel receptors
 - * b. meissner corpuscles and merkel receptors
 - c. pacinian and ruffini corpuscles
 - d. pacinian corpuscles and merkel receptors
 - e. free nerve endings and ruffini corpuscles

17. You are testing a patient for potential loss of tactile discrimination. Across the body surface, two-point discrimination thresholds (in mm) are normally lowest in the _____, and highest in the _____.
- a. lip, fingers
 - b. lip, foot
 - c. foot, back
 - d. fingers, cheek
 - * e. fingers, calf
18. Which of the following statements about somatosensory primary afferent axons and their receptors is FALSE?
- a. Receptors are proteins that are inserted into axonal membranes.
 - b. Energy impinging on the body tissues is converted into electrical signals by receptors and related ion channels.
 - * c. Receptor potentials are conducted up axons to the central endings of primary sensory neurons.
 - d. Receptor potentials involve movements of positive ions into ends of afferent axons.
 - e. Signals are normally conducted only in the distal to proximal direction in primary afferent neurons.
19. Which of the following statements is not true of primary hyperalgesia?
- a. It involves abnormally intense pain from inflamed tissues.
 - b. It can result from tissue accumulation of substances such as bradykinin, histamine, and prostaglandins.
 - * c. It is primarily due to hypersensitivity in the central nervous system.
 - d. It involves increased receptor sensitivity of peripheral free nerve endings.
 - e. It involves increased discharges of action potentials in pain afferent fibers to noxious stimuli.
20. All the following typically contain somatosensory primary afferent neurons except:
- a. nerves
 - b. dorsal columns
 - c. ganglion of the VII cranial nerve
 - d. plexuses
 - * e. ventral roots
21. Which of the following statements about dermatomes is TRUE?
- a. A dermatome is the receptive field of a peripheral nerve.
 - b. There are 12 cervical dermatomes.
 - * c. The dermatomes involving the hand are not coextensive with the sensory territories of the peripheral nerves to the hand.
 - d. A dermatome is smaller than the receptive field of a primary sensory neuron.
 - e. Dermatomes are principally defined by pain afferent innervation.

22. The cell bodies of somatosensory primary sensory neurons that enter the central nervous system at brainstem levels are contained in the following ganglia:

- a. trigeminal, C1, C2, jugular
- * b. trigeminal, petrosal, jugular, nodose, geniculate
- c. spiral, trigeminal, vestibular
- d. C1, C2, trigeminal
- e. jugular, petrosal, maxillary, mandibular, ophthalmic

23. Your patient has a lesion in one of the central termination zones of primary somatosensory neurons. You have ruled out involvement of the main trigeminal nucleus and spinal cord. The remaining possibilities include the:

- a. hypoglossal nucleus and ventroposterior lateral nucleus
- * b. dorsal column nuclei and solitary nucleus
- c. spinal trigeminal nuclei and ventroposterior medial nucleus
- d. interpolar trigeminal nucleus and inferior olive
- e. none of the above

24. Somatosensory primary afferents from abdominal viscera travel within the _____ nerve, _____ ganglion, and _____ tract, and terminate in the _____.

- * a. vagus, nodose, solitary, solitary nucleus
- b. glossopharyngeal, petrosal, trigeminal, spinal trigeminal nuclei
- c. vagus, jugular, solitary, spinal trigeminal nuclei
- d. trigeminal, trigeminal, trigeminal, spinal trigeminal nuclei
- e. none of the above

25. With regard to somatotopic organization in the spinal cord, inputs from lower-to-upper body locations are represented in a _____ sequence in the spinal grey, and in a _____ sequence in the cervical dorsal column white.

- a. rostral-caudal, medial-lateral
- b. dorsal-ventral, ventral-dorsal
- c. medial-lateral, caudal-rostral
- * d. caudal-rostral, medial-lateral
- e. none of the above

26. The main locations of the central synapses of pain primary sensory neurons from skin on the left half of the body and face are in the:

- a. right dorsal horn and right solitary nucleus
- b. left and right dorsal horns
- c. left dorsal column and main trigeminal nuclei
- d. right dorsal horn and right dorsal column nuclei
- * e. left dorsal horn and left spinal trigeminal nuclei

27. Touch-related signals in primary afferents entering the spinal cord travel up the following sequence of white matter tracts to reach cortex:

- a. ipsilateral dorsal column; ipsilateral trigeminothalamic tract; ipsilateral external capsule
- * b. ipsilateral dorsal column; contralateral medial lemniscus; contralateral internal capsule
- c. contralateral lateral column; ipsilateral spinothalamic tract; ipsilateral extreme capsule
- d. contralateral dorsal column; contralateral medial lemniscus; contralateral external capsule
- e. ipsilateral trigeminal tract; contralateral trigeminal lemniscus; contralateral internal capsule

28. Which of the following statements about the major ascending system for touch from the face is FALSE?

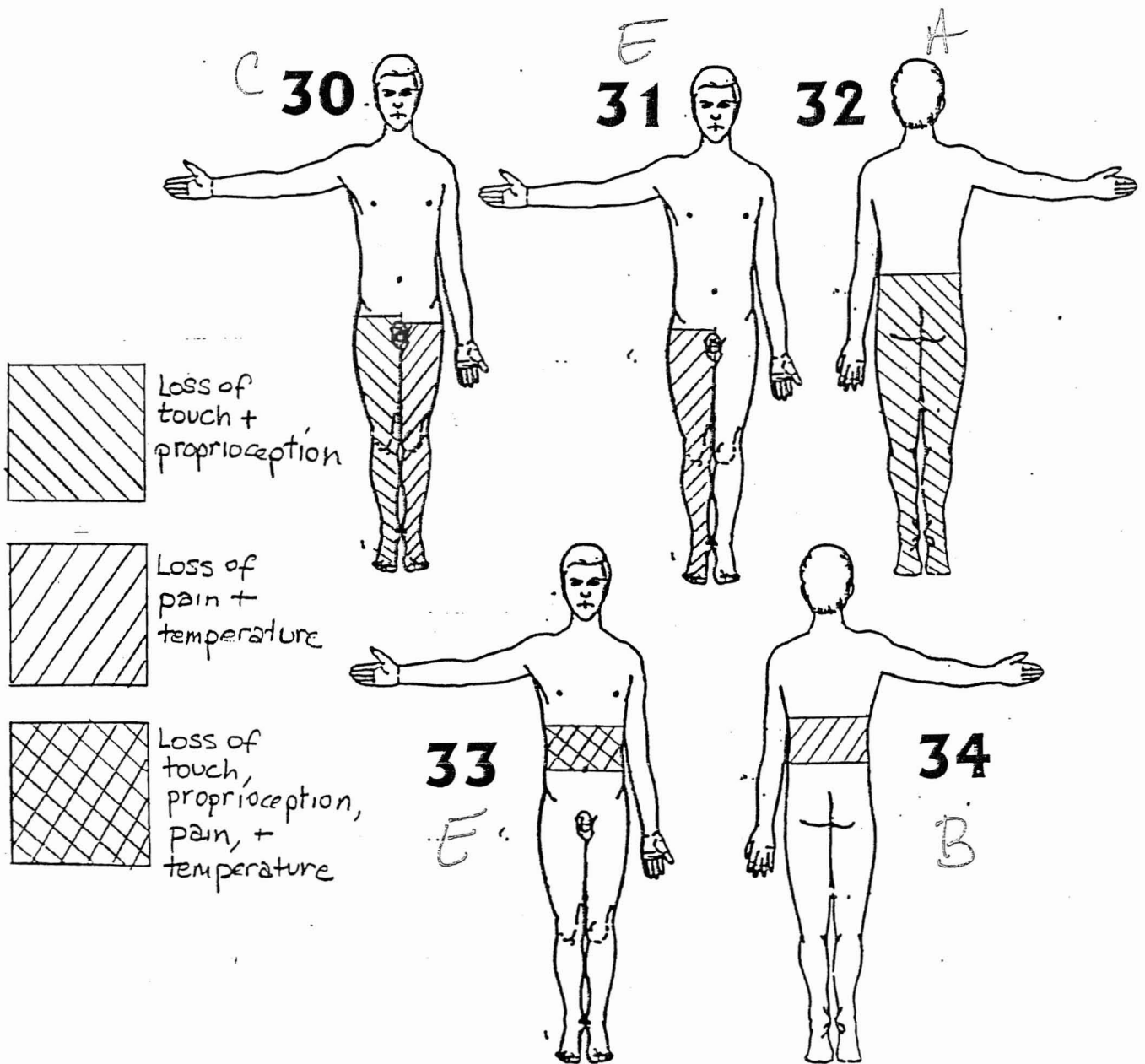
- a. It involves trigeminal lemniscus axons that are contralateral to the related primary sensory neurons.
- b. It involves third order neurons in the thalamus.
- c. It involves axons that decussate in the brainstem.
- d. It involves axons that project through the midbrain.
- * e. It involves synapses in the vpl (ventroposterior lateral) nucleus

29. Primary somatosensory cortical areas representing afferent inputs from the left side lower limb, upper limb, and face are represented in a respective:

- a. lateral to medial order from the lateral fissure to the midsagittal fissure of the left hemisphere.
- b. lateral to medial order from the lateral fissure to the midsagittal fissure of the right hemisphere.
- c. medial to lateral order from the midsagittal fissure to the lateral fissure of the left hemisphere.
- d. lateral to medial order in the left occipital lobe
- * e. medial to lateral order from the midsagittal fissure to the lateral fissure of the right hemisphere.

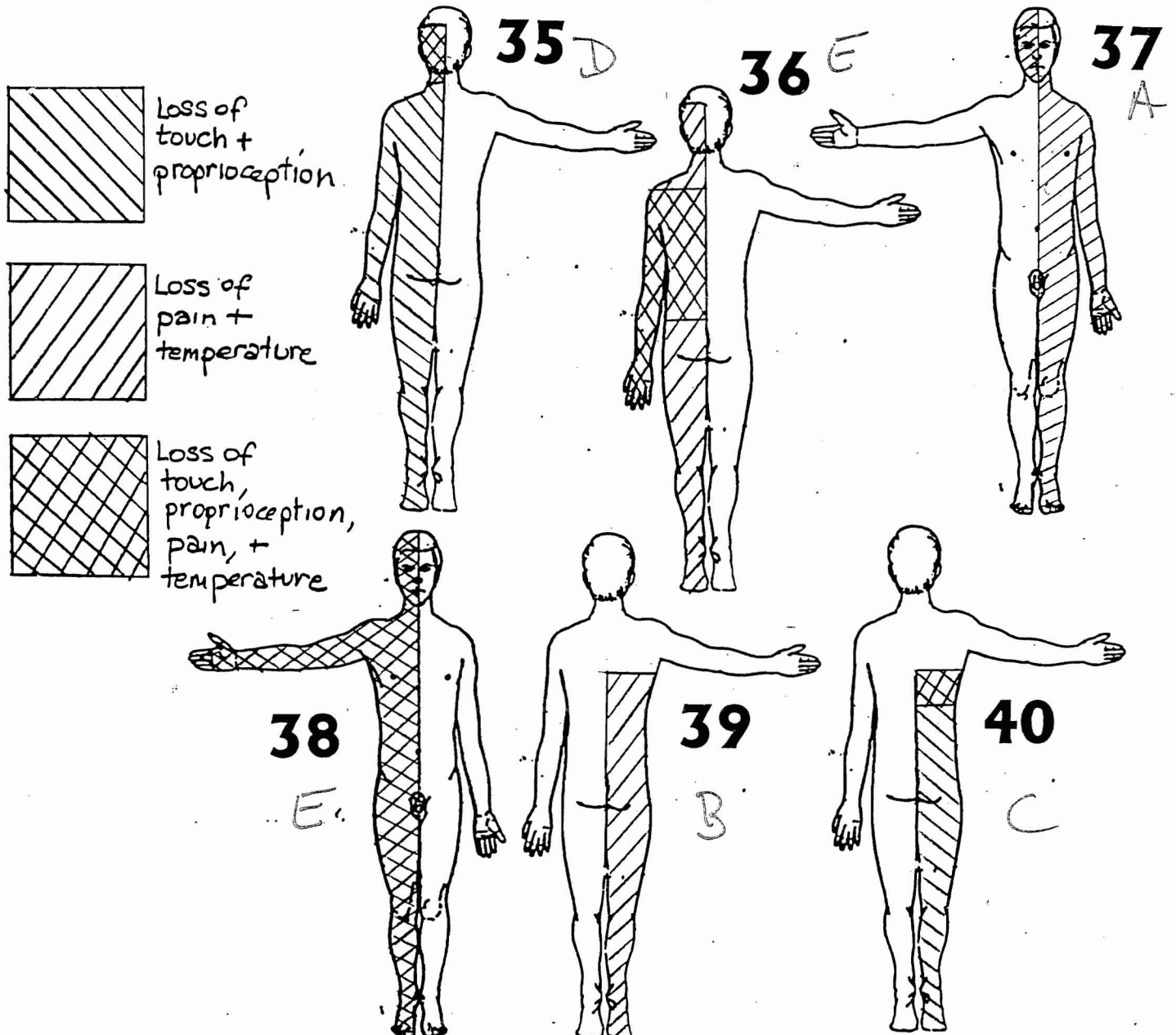
For questions 30-34, match the indicated sensory deficit pattern on each drawing with the appropriate description of lesions in choices a-e. Choices may be used once, more than once, or not at all.

- a. complete bilateral lesion of the dorsal columns at a low thoracic level
- b. lesion extending across 3-4 segments and involving the grey around the central canal plus adjacent midline anterior column white at a low thoracic level
- c. section of the entire right half of the spinal cord at a high lumbar level
- d. complete bilateral section of the spinal cord at a low thoracic level
- e. a-d do not apply to this pattern of sensory loss



For questions 35-40, match the indicated sensory deficit pattern on each drawing with the appropriate description in a-e. Choices may be used once, more than once, or not at all.

- a. lesion of the spinal trigeminal nucleus and anterolateral tract on the right side at a medulla level
- b. complete section of the left anterolateral tract at a high thoracic level
- c. complete unilateral section of the right dorsal column and adjacent 3-4 dorsal roots at high thoracic (T4-7) level
- d. complete unilateral section of the left dorsal column and adjacent dorsal roots at high cervical (C2-3) levels
- e. a-d do not apply to this pattern of sensory loss



CHOOSE THE BEST ANSWER

41. Which of the following statements about somatosensory cortical areas is FALSE?
- a. The primary somatosensory cortex is actually 4 cortical areas.
 - b. The posterior parietal somatosensory cortex includes areas 7,5,40, and 39.
 - c. Lateral sulcus somatosensory cortical areas include the secondary somatosensory cortex, insular cortex, and retroinsular cortex.
 - * d. Somatosensory cortical areas are part of the allocortex.
 - e. Somatosensory cortical areas in the two hemispheres communicate via the corpus callosum.
42. Which of the following changes occurs in the primary somatosensory cortex of humans after right forearm amputation?
- a. The representation of the left foot moves into the cortical space normally representing the missing hand in the right hemisphere.
 - b. The representation of the right face moves into the cortical space normally representing the missing hand in the right hemisphere.
 - c. The representations of the right face and upper arm move into the cortical spaces normally representing the hand in both hemispheres.
 - * d. The representations of the right face and upper arm move into the cortical space normally representing the missing hand in the left hemisphere.
 - e. The cortical space normally representing the missing hand in the right hemisphere no longer responds to stimulation of the body.
43. Spontaneous feelings of numbness, tingling, or prickly sensations from a body region are referred to as:
- a. astereognosis
 - * b. paresthesias
 - c. analgesia
 - d. allodynia
 - e. tinglingitis
44. Burning pains that may be related to nerve injury and changes in appearance of the skin are referred to as:
- a. hypalgesia
 - b. hypesthesia
 - c. atopognosis
 - d. anesthesia
 - * e. causalgia
45. Which of the following statements about pain perception in a normal body is FALSE?
- a. Normal pain perception involves neurons in the anterolateral tract system and associated cortical areas.
 - b. Normal pain perceptions can be initiated by activity in C-fiber primary afferents.
 - * c. Normal pain perceptions can be triggered by activation of low threshold, A-beta sensory afferents.
 - d. A normal perception of pain is caused by a noxious stimulus.
 - e. A normal percept of pain is a central nervous system event that requires activation of appropriate populations of central neurons.

46. Which of the following statements about pathological pain is FALSE?
- a. Pathological pain involves changes in the normal organization of pain circuits.
 - b. Pathological pain can be generated in the absence of any stimulus.
 - c. Pathological pain can be triggered by activation of low threshold, A-beta sensory afferents.
 - d. Pathological pain can be caused by sensitization of primary afferent neurons.
 - * e. Pathological pain percepts are not triggered by nonnoxious stimuli.
47. One major theory of pathological pain suggests that second order spinal neurons become hypersensitive. The initial requirement for producing this hypersensitivity is:
- a. death of primary sensory neurons
 - b. pathological regeneration of injured primary sensory neurons
 - * c. a body wall state that causes nociceptive primary afferents to co-release excitatory amino acids and peptides
 - d. death of cortical neurons
 - e. abnormally high levels of activity in somatosensory cortical areas
48. One mechanism for producing pathological pain involves the sympathetic nervous system. In this mechanism, sympathetic neurons contribute to abnormal pain by:
- * a. direct activation and sensitization of nociceptor terminations
 - b. causing the death of low threshold A-beta afferents
 - c. sensitizing central synapses of spinal neurons
 - d. decreasing central inhibition
 - e. increasing catecholamine release onto cortical cells.
49. Inositol triphosphate (IP_3) increases:
- A. protein kinase C activity.
 - * B. intracellular Ca^{2+} levels.
 - C. phospholipase C activity.
 - D. adenylyl cyclase activity.
 - E. GTP binding to a G protein.
50. The proteins, G_s and G_i :
- * A. have three subunits.
 - B. have the same α subunit.
 - C. inhibit adenylyl cyclase.
 - D. are coupled to the β -norepinephrine receptor.
 - E. interact with ligand-gated neurotransmitter receptors.
51. The only neurotransmitter which binds to receptor subtypes which activate an ion channel or inhibit adenylyl cyclase is:
- * A. acetylcholine.
 - B. dopamine.
 - C. GABA.
 - D. substance P.
 - E. glutamate.

52. Which of the following is NOT needed to synthesize cyclic AMP in response to norepinephrine?
- A. G_s
 - B. ATP
 - C. β -norepinephrine receptor
 - D. Adenylyl cyclase
 - * E. Cyclic AMP-dependent protein kinase
53. Which of the following is a correct pairing between a neurotransmitter receptor and a second messenger which is formed when it is activated?
- A. Nicotinic cholinergic receptor: IP_3
 - * B. m1 Muscarinic cholinergic receptor: Diacylglycerol
 - C. β -Adrenergic receptor: G_s
 - D. $GABA_A$ receptor: Cl^-
 - E. D1 Dopaminergic receptor: IP_3
54. Activation of both NMDA and m1 muscarinic receptors leads to increases in intracellular levels of:
- A. diacylglycerol.
 - B. IP_3 .
 - C. cyclic AMP.
 - * D. Ca^{2+} .
 - E. Cl^- .
55. Both Parkinson's Disease and schizophrenia:
- A. involve the nigral/striatal system.
 - B. result from a loss of dopamine.
 - C. involve an autoimmune response against a dopamine receptor.
 - * D. result from pathology in a dopaminergic pathway in the brain.
 - E. can be helped by inhibiting monoamine oxidase activity with deprenyl.
56. Nicotinic and muscarinic receptors have the same:
- A. antagonist specificity.
 - B. tissue distribution.
 - C. subunit composition.
 - D. coupling to a second messenger system.
 - * E. neurotransmitter ligand.
57. Which of the following is a correct pairing between a neurotransmitter and the enzyme which degrades it?
- A. Acetylcholine: choline acetyltransferase
 - * B. Serotonin: monoamine oxidase
 - C. Norepinephrine: tyrosine hydroxylase
 - D. Dopamine: dopamine β -hydroxylase
 - E. GABA: glutamic acid decarboxylase

58. Serotonin, unlike norepinephrine, is:
- A. broken down by monoamine oxidase.
 - * B. derived from tryptophan.
 - C. synthesized in a reaction catalyzed by l-aromatic amino acid decarboxylase.
 - D. a catecholamine.
 - E. synthesized in a pathway which utilizes tyrosine hydroxylase.
59. Glycine can be distinguished from GABA by its ability to:
- A. bind to a ligand-gated receptor.
 - B. activate a Cl^- channel.
 - C. hyperpolarize neurons.
 - D. mediate presynaptic inhibition.
 - * E. be blocked by strychnine.
60. The transamination of GABA also produces:
- A. α -ketoglutarate.
 - * B. glutamate.
 - C. CO_2 .
 - D. succinic acid.
 - E. NADH.
61. A characteristic common to GABA and methionine enkephalin is:
- * A. interaction with presynaptic receptors.
 - B. a receptor which is a Cl^- channel.
 - C. synthesis in the neuronal cell body with transport to the presynaptic terminal.
 - D. potentiation by benzodiazepines.
 - E. that both are peptides.
62. Both NMDA and AMPA/Kainic acid receptors:
- A. are blocked by Mg^{2+} under basal conditions.
 - B. have an ion channel that permits flow of Ca^{2+} .
 - * C. bind glutamate.
 - D. increase cyclic AMP levels in neurons.
 - E. stimulate calmodulin-dependent processes.
63. Pro-opiomelanocortin (POMC):
- A. contains the sequence of leucine enkephalin.
 - B. is found in high concentrations in the dorsal horn of the spinal cord.
 - C. contains multiple copies of methionine enkephalin.
 - * D. is a precursor to a peptide with opiate activity.
 - E. is released from primary sensory afferents in the spinal cord.

64. Which of the following statements concerning the cranial nerve nucleus which receives input from tastebuds is true?
- A. It is called the nucleus ambiguus.
 - B. It receives major inputs from cranial nerve VIII.
 - C. It lies in the midbrain.
 - * D. The nucleus forms a column which extends through the medulla
 - E. None of the above.
65. The ciliary ganglion
- A. Is supplied by preganglionic axons originating in the Edinger Westphal nucleus.
 - B. Is in the efferent limb of the light reflex.
 - C. Contains postganglionic neurons which innervate the iris and ciliary body.
 - D. When activated will cause pupillary constriction.
 - * E. All of the above.
66. The mesencephalic nucleus of V
- * A. Contains primary sensory neurons carrying information from the face.
 - B. Is supplied by the preganglionic axons originating in the motor nucleus of V.
 - C. Contains neurons which project to the solitary nucleus.
 - D. Lies outside of the brainstem.
 - E. All of the above.
67. Which statement concerning the trigeminal nerve is FALSE?
- A. It exits the brainstem from the ventral surface of the pons.
 - B. Its motor nucleus is in the pons.
 - * C. It provides motor innervation to the muscles of facial expression.
 - D. It carries pain and temperature information from the face.
 - E. It is not associated with a peripheral sensory ganglion.
68. What would you expect to happen following a lesion of the left hypoglossal nerve?
- A. Degeneration of an ipsilateral nucleus lying on the ventral midline of the medulla.
 - B. Atrophy of the right half of the tongue.
 - C. Deviation of the tongue to the right side.
 - D. Loss of taste sensation on the right side.
 - * E. None of the above.
69. Which statement concerning the vagus nerve is true.
- A. Some of its efferent axons innervate tongue muscles.
 - * B. Some of its efferent axons innervate striated muscle.
 - C. Activity in the vagus nerve accelerates the heart rate.
 - D. Lesion of the vagus is not associated with hoarseness.
 - E. None of the above.

For the next 4 questions, use the letters marked on the figure below to identify the structures described. A choice may be used once, more than once, or not at all.

- 70. Region of Somatic Efferent column.
- 71. Region of Visceral Afferent column.
- 72. Exit region for hypoglossal nerve.
- 73. Region where you would expect to find the dorsal motor nucleus of the vagus.

CHOOSE THE BEST ANSWER

- 74. Occulomotor nerve axons
 - * A. innervate all of the extraocular muscles except lateral rectus and superior oblique.
 - * B. innervate all of the extraocular muscles except medial rectus and inferior oblique.
 - C. emerge from the dorsal surface of the midbrain.
 - D. emerge from a single nucleus.
 - E. innervates contralateral eye muscles.
- 75. The major pathway by which information about sound is carried into the inferior colliculus is called:
 - A. Auditory nerve
 - B. Trapezoid body
 - C. Acoustic stria
 - * D. Lateral lemniscus
 - E. Brachium of the inferior colliculus
- 76. The main factor enabling airborne sound signals to efficiently elicit vibrations in the cochlear fluids is:
 - * A. The area of the tympanic membrane is much larger than the area of the oval window
 - B. Contraction of the tensor tympani muscle
 - C. Opening of the Eustachian tube
 - D. Elevated fluid pressure in the middle ear
 - E. Bending of cilia of the outer hair cells

77. When the stereocilia on inner hair cells bend in a direction toward the longer stereocilia, the two ions whose entry into the hair cells greatly increases are:
- * A. Sodium and calcium
 - B. Chloride and sodium
 - C. Potassium and calcium
 - D. Chloride and calcium
 - E. Chloride and magnesium
78. A feature of information processing in the medial geniculate is:
- A. Some of the neurons selectively respond to specific time intervals between sounds of two different frequencies
 - B. It is the first auditory nucleus where sound localization is coded
 - C. There is no clear tonotopic organization
 - * D. Most input to its neurons comes from the cochlear nucleus
 - E. The dorsal division functions as the major thalamocortical relay
79. Neurons of the cochlear nucleus with precise firing at tone onset and broad tuning curves are:
- A. Spherical bushy cells
 - * B. Octopus cells
 - C. Fusiform cells
 - D. Globular bushy cells
 - E. Purkinje cells
80. Which of the following is not true concerning the coding of sound location in space:
- A. Neurons project from both cochlear nuclei to both medial superior olivary nuclei (MSO)
 - B. Neurons project from each cochlear nucleus to the ipsilateral lateral superior olivary nucleus (LSO)
 - C. Neurons project from each cochlear nucleus to the contralateral medial nucleus of the trapezoid body (MNTB)
 - * D. Each medial nucleus of the trapezoid body (MNTB) projects to the contralateral lateral superior olivary nucleus (LSO)
 - E. The medial superior olivary nucleus (MSO) is involved in localization mainly of low frequency sounds
81. The primary area of the auditory cortex:
- A. Receives major innervation from the inferior colliculus
 - B. Sends a major projection to the cochlea
 - C. Is located in the frontal lobe of the brain
 - D. Receives diffuse input from the belt areas of the medial geniculate
 - * E. Contains tonotopic and binaural interaction maps oriented at right angles to each other

82. Of the following, which is least closely related to vestibular functions:

- A. Flocculonodular lobe of cerebellum
- B. Abducens nucleus
- C. Medial longitudinal fasciculus
- D. Sacculus
- * E. Lateral lemniscus

83. Concerning the vestibular nerve:

- * A. Larger-diameter fibers synapse mostly with flask-shaped hair cells
- B. Neurons are pseudounipolar, similar to primary somatosensory neurons
- C. Most neurons have no activity in the absence of head movements
- D. Most neurons synapse with cells of the solitary nucleus
- E. All of the above

84. Concerning the utricle:

- A. The cupula moves during linear accelerations
- * B. Linear acceleration in any horizontal direction depolarizes some hair cells and hyperpolarizes others in each macula
- C. Angular acceleration in a vertical plane depolarizes all hair cells in one utricle and hyperpolarizes all hair cells in the other utricle
- D. Hair cells form synapses with supporting cells in the crista
- E. Vestibular nerve fibers synapse at the basal parts of the otoconia

85. The reflex most closely related to vestibular function is:

- A. Accommodation reflex
- B. Stretch reflex
- * C. Righting reflex
- D. Pupillary reflex
- E. Withdrawal reflex

86. In the caloric test for vestibular function:

- A. Each otolith organ can be tested separately.
- B. The direction of nystagmus is to the right when cold water is put into the right ear.
- * C. The head is tilted such that the horizontal canals assume a vertical orientation.
- D. The patient is turned in a rotating chair.
- E. The patient stands with eyes closed and feet together.

87. In the auditory brain stem evoked response:

- A. A computer is used to average electrical waves recorded from the head during presentation of a stimulus.
- B. A brief sound stimulus is presented to an ear repetitively, about 2000 times.
- C. Separate peaks in the averaged electrical waves correspond to activation of different auditory structures of the brain.
- D. Absence of later peaks may occur in a patient with a tumor at the cerebellopontine angle.
- * E. All of the above.

88. A common cause of conductive hearing loss is:

- * A. Fluid in the middle ear
- B. Exposure to loud noise
- C. Ototoxic damage to hair cells
- D. Acoustic neuroma
- E. Increased endolymph pressure

89. Which of the following is not a symptom of Ménière's disease:

- A. Spells of vertigo
- * B. Hearing loss more for high than for low frequencies
- C. Fluctuating hearing loss
- D. Feeling of increased pressure in the ear
- E. Tinnitus